Claims

1. Method to distinguish, whether an event sequence is a memory driven event sequence or is not a memory driven event sequence on a time scale T_1 to T_2, where $T_1 < T_2$ are arbitrary times,
characterized in that
   a) the first order autocorrelation function $G(\tau)$ of the event sequence is calculated,

   b) the second order autocorrelation function $G(\tau_1,\tau_2)$ of the event sequence is calculated,

   c) it is decided that the event sequence is a memory driven event sequence on the time scale T_1 to T_2,
      if the second order autocorrelation function of the event sequence can be expressed within experimental error as the product of first order autocorrelation functions, i.e. $G(\tau_1,\tau_2) = G(\tau_1)*G(\tau_2)$ for $T_1 < \tau_1, \tau_2 < T_2$, and

   d) it is decided that the event sequence is not a memory driven event sequence on the time scale T_1 to T_2,
      if the second order autocorrelation function of the event sequence cannot be expressed within experimental error as the product of first order autocorrelation functions, i.e. $G(\tau_1,\tau_2) \neq G(\tau_1)*G(\tau_2)$ for $T_1 < \tau_1, \tau_2 < T_2$.

2. Method according to claim 1,
characterized in that

a) the first order autocorrelation function $G(\tau)$ of the event sequence is calculated as:

$$G(\tau) \equiv \frac{E(X_0 X_\tau)}{E(X_0)E(X_\tau)}$$

where X is the random variable that describes the event and E(.) denotes the expectation value,

b) the second order autocorrelation function $G(\tau_1, \tau_2)$ of the event sequence is calculated as:

$$G(\tau_1, \tau_2) \equiv \frac{E(X_0 X_{\tau_1} X_{\tau_1+\tau_2})}{E(X_0)E(X_{\tau_1})E(X_{\tau_1+\tau_2})}$$

where X is the random variable that describes the event and E(.) denotes the expectation value,

3. Method according to claim 1, characterised in that the degree of memory of the system is quantified by the non-Markovian function NMF calculated according to:

$$\mathrm{NMF}(\tau_1, \tau_2) = p_f\left(\frac{G(\tau_1, \tau_2)}{G(\tau_2)} - G(\tau_1)\right),$$

where p_f is the probability of the event X at a particular time.

4. Method according to claim 1,
characterized in that
the event sequence is a sequence of fluorescence events observed in a confocal microscope.

5. Method according to claim 4 to discriminate an event sequence from a single molecule against an event sequence from background processes or noise,

characterized in that

a) it is decided that the event sequence is due to a single molecule, if it is a memory driven event sequence,

b) it is decided that the event sequence is due to background processes or noise, if it is a non-memory driven event sequence.

6. Method according to claim 5 for single molecule sequencing,

characterized in that

a) it is decided that the fluorescence events observed are due to nuclease-liberated nucleotides if the sequence of fluorescence events is a memory driven sequence of events and

b) it is decided that the fluorescence events observed are due to contaminating nucleotides or other background signals, if the sequence of fluorescence events is not a memory driven sequence of events.

7. Method according to claim 6, characterized in that the fluorescence events are observed in a confocal microscope.

8. Method according to claim 6 or 7 for analyzing of catalytic complexes, characterized in that

a) it is decided that the fluorescence events observed are due to characteristics of the catalytic complex if the sequence of fluorescence events is a memory driven sequence of events and

b) it is decided that the fluorescence events observed are due to contaminating nucleotides or other background signals, if the

sequence of fluorescence events is not a memory driven sequence of events.

9. Method according to claim 8, characterized in that the catalytic complex comprises a catalyst, a substrate being converted to a product and optionally a cosubstrate.

10. Method according to claim 8 or 9, characterized in that the catalyst is selected from biomolecules, e.g. enzymes, inorganic molecules and organic molecules.

11. Method according to one of the claims 5 - 10 wherein an oscillating process is analyzed.